Appendix A – 2014 Sustainability Inventory

This document presents key data snapshots from Sound Transit's 2014 Sustainability Inventory and identifies patterns of resource use compared to 2013 and earlier years of performance.

Sound Transit has made a number of valuable improvements to the quality and sustainability of its service. Changes in resource use and efficiency varied in 2014, depending on how agency data is normalized.

- Notably, the agency continues to grow its ridership more quickly than its use of natural resources.
- Ridership continued to grow, reaching nearly 33 million boardings - an increase of nearly 3 million from 2013.
- Total resource use and emissions increased in some areas as the agency expanded service on the existing system, ramped up new service for 2016 and beyond and increased staffing.

Ridership

Ridership increased substantially in 2014, continuing to build on previous years' growth to reach nearly 33 million boardings (unlinked passenger trips), which is an increase of approximately 3 million from 2013. (Note the data below do not include paratransit).

- Total boardings increased by 8.6 percent, led by a 13 percent increase in Link light rail boardings.
- The amount of service provided (revenue vehicle miles) increased by 0.8 percent across all services.
- Overall, higher efficiency was achieved in terms of passengers served per mile of service.

Regional Environmental Benefit

As Sound Transit expands to provide more service across the region, the agency increases its own resource use. However, improved bus and train services reduce regional environmental impacts. As more people choose transit over driving alone, fuel and greenhouse gas emissions are saved throughout the region.

Greenhouse gas emissions savings are one way to measure the regional environmental benefit produced by transit. Sound Transit follows a methodology developed by the American Public Transportation Association (APTA) and The Climate Registry to account for savings from transit ridership, measured as carbon dioxide equivalents (CO_2e), as shown in Table 1. Greenhouse gas emissions can also serve as a proxy for fuel use savings.

Table 1. Regional Greenhouse Gas Emissions (CO_2e) Savings from Sound Transit, 2014

Regional Tons CO_2e Saved			
Mode Shift Benefits	Congestion Benefits	Land Use Change	Total Benefits
98,019	39,911	253,707	391,637
Displacement ratio: CO_2e units saved in the region per unit of CO_2e from Sound Transit operations			
Mode Shift Benefits	Congestion Benefits	Land Use Change	Total Benefits
1.6	0.6	4.1	6.3

- Mode shift benefits measure the reduced greenhouse gas emissions resulting from shifting from one mode of transportation (e.g., single occupancy vehicle) to another (e.g., transit), measured on a per-passenger-mile basis.
- Congestion benefits quantify the secondary effect of transit—opening roadway capacity, which in turn means smoother traffic flow and fewer stops, starts and traffic jams. (Note: As per APTA guidance, the number reported above was calculated using data from Texas Transportation Institute's 2012 Urban Mobility Report, the most recently published report.)
- Land use change benefits measure the reduced carbon outputs due to the denser land-use patterns created by transit systems.

Note: Sound Transit reports the benefits from mode shift and congestion relief, but not land use change in the 2014 Sustainability Progress Report, as the data for that metric is not as robust as the other two data points.

Agency Greenhouse Gas Emissions

- In 2014, Sound Transit emitted 61,915 metric tons of greenhouse gas emissions ($MTCO_2e$) from transit and non-revenue vehicles and facilities.
- The combustion of diesel fuel accounts for 90 percent of Sound Transit's greenhouse gas emissions.
- For every ton of greenhouse gas emissions produced by the agency, 2.2 times that amount was saved throughout the region (from mode shift and congestion benefits).

Resource Use

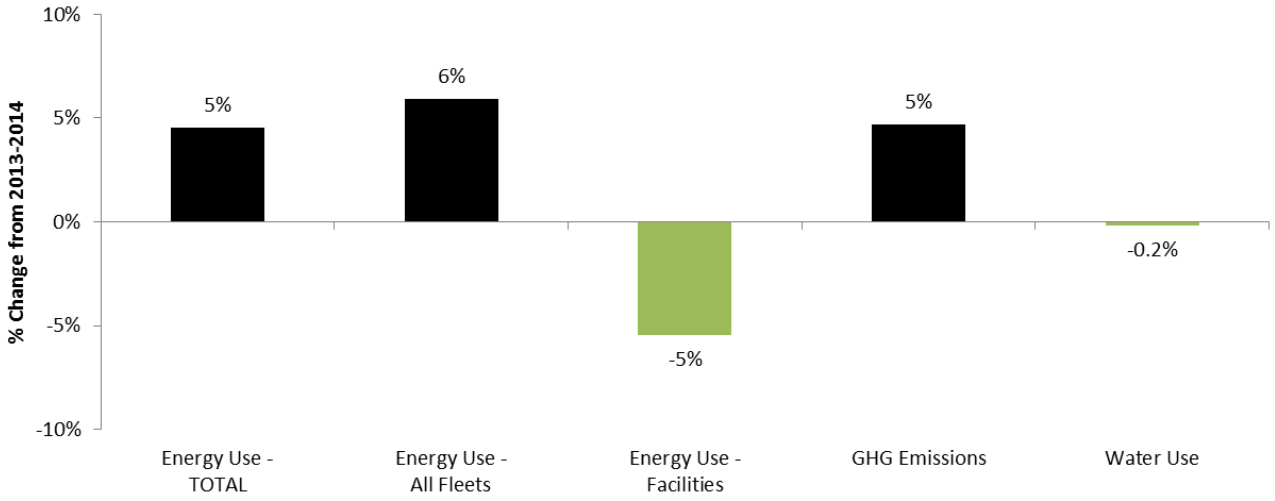
As expected, resource use increased overall in 2014, although services were more efficient per passenger. This reflects Sound Transit's increase in services to accommodate growing ridership as well as the ST2 expansion efforts underway. Although targeted fleet and facility energy conservation efforts were successful, they were outweighed by overall growth in resource use across the expanding system.

- Fleet energy use - increased 6 percent, with diesel fuel for Sounder commuter rail and ST Express buses, as well as compressed natural gas (CNG) for ST Express buses, driving this increase.

    - Sounder commuter rail fuel consumption increased 10 percent from adding three new locomotives and trips associated with providing the first full year of service from Lakewood to Tacoma, and temporarily decommissioning wayside power units (which electrify the trains while they are in layover to reduce fuel use) in Everett and relocating the wayside power units from Tacoma to Lakewood.
    - ST Express buses increased fuel use by nearly 5 percent, due to replacement of several diesel buses with higher capacity diesel buses to accommodate increasing ridership. Replacing the 40 foot buses with 60 foot buses is more efficient overall, as fewer buses are needed to accommodate larger numbers of riders. Additionally, when comparing a given bus type across years, the fuel economy improved between 1 and 4 percent, depending on the model, from 2013 to 2014.
    - Link light rail electricity use decreased by 1 percent from the previous year. However, this reduction is relative to an anomalous spike in the previous year's consumption.
- Total greenhouse gas emissions – increased at 5 percent. The growth of greenhouse gas emissions was slightly lower than the growth in fuel use because of cleaner ST Express buses and Sounder trains. While most criteria air pollutants increased between 1 to 10 percent (depending on the pollutant), particulate matter decreased by 3 percent from the previous year.
- Total water use - was stable between 2013 and 2014, although use for various functions fluctuated considerably. Water use at customer facilities, as well as for administrative and property management, was down, as a result of indoor water efficiency upgrades and increased monitoring of landscaping and irrigation practices. Water use at maintenance facilities increased by 42 percent, but costs did not rise accordingly because the use of a deduct meters resulted in significant financial savings. This meter credits Sound Transit for irrigation water that does not enter the waste water stream.
- Total waste generation – increased 11 percent but the proportion of waste that was recycled and composted increased by 25 percent. Overall, the agency recycled and composted more than a third of that stream; the overall waste diversion rate increased from 34 percent in 2013 to 38 percent in 2014.
- Non-revenue fuel use – makes up 1 percent of total agency energy use and recorded just over 10 percent increase in fuel use, in accordance with the increase in agency staffing and number of active planning and construction projects that require on site visits.

Figure 1. Change in Total Resource Use and Emissions, 2013–2014[1]

This figure indicates changes in total resource use for the agency, without taking into consideration the number of riders or hours of service provided.



[1] Change in emissions from the previous year is not directly comparable to emissions reported in Sound Transit's 2013 Sustainability Progress Report as methodology for calculating emissions changed during this period.

Resource Use Efficiency

Sound Transit tracks resource efficiency by two separate measures: resource consumption normalized by ridership (boardings) and normalized by service (vehicle revenue miles). As a growing agency, Sound Transit's overall resource use will continue to expand. However, these normalized metrics help the agency understand how efficiently it is growing and operating. These metrics were developed by APTA and are used by the signatories of the APTA Sustainability Commitment to measure annual progress.

Resource Use per Boarding

Resource consumption showed improvements per boarding, as ridership growth outpaced increases in resource use.

- Fleet energy use - decreased by 3 percent per boarding. As Table 2 indicates, this trend was driven by Link light rail, which carried more riders while using less energy per revenue mile.
- Facility energy use - decreased by 13 percent per boarding, a trend driven by the energy efficiency upgrades to four large facilities, as well as a much warmer year.
- Greenhouse gas emissions - decreased by 4 percent per boarding. Other air pollutant patterns included a decrease of 11 percent for particulate matter (PM) emissions per boarding, while emissions of carbon monoxide (CO) per boarding increased by 1 percent.
- Water use - decreased by 8 percent per boarding as a result of facility and landscaping efficiency efforts.

Figure 2. Change in Resource Use and Emissions per Boarding, 2013–2014

This figure indicates changes in how efficiently Sound Transit consumes natural resources in relation to ridership, so the results are affected by how many trips riders take on Sound Transit services. Efficiencies are shown in green, and growth patterns are shown in black.

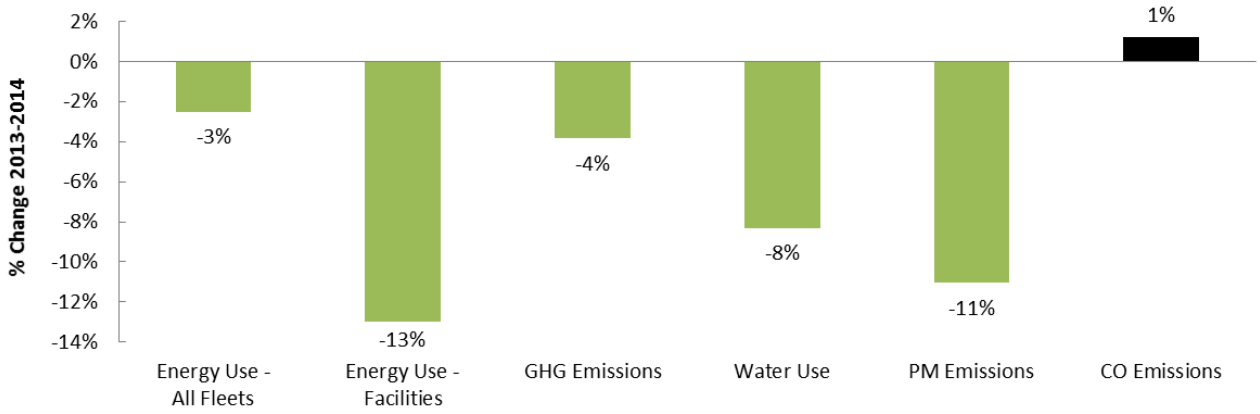


Table 2. Change in Energy Use by Mode per Boarding, 2013–2014

Mode	% Change Energy Use per Boarding
Sounder Commuter Rail (diesel)	1%
ST Express Buses (diesel and natural gas)	-3%
Link light rail traction power (electricity)	-9%

Resource Use per Mile of Service

As the agency added service across modes and adjusted operations practices to accommodate increased ridership and staffing levels, Sound Transit decreased resource use in some areas and increased in others in 2014.

- Fleet energy use - increased by 5 percent per revenue mile and greenhouse gas emissions also increased by 4 percent per revenue mile. Again, this reflects the shift to larger ST Express buses and the changes to Sounder Commuter rail service as discussed in the previous section. Efficiency gains in Link light rail were outweighed by energy use increases on Sounder commuter rail. See Table 3.
    - ST Express bus fuel use was static per platform mile, Link light rail electricity use decreased by 2 percent per revenue mile and Sounder commuter rail fuel use increased by 9 percent per revenue mile.
- Facility energy use - decreased by 6 percent per revenue mile likely due to LED lighting, HVAC (heating, ventilation and cooling) system and boiler upgrades at several ST facilities, as well as reduced need for heating due to a warmer year.

- Water use – decreased by 1 percent per revenue mile, for reasons discussed in the Resource Use section.

Figure 3. Change in Resource Use and Emissions per Mile of Service, 2013–2014

This figure illustrates how efficiently Sound Transit consumed natural resources in relation to the volume of service provided. These results are not affected by ridership. Efficiencies are shown in green, while growth patterns are shown in black.

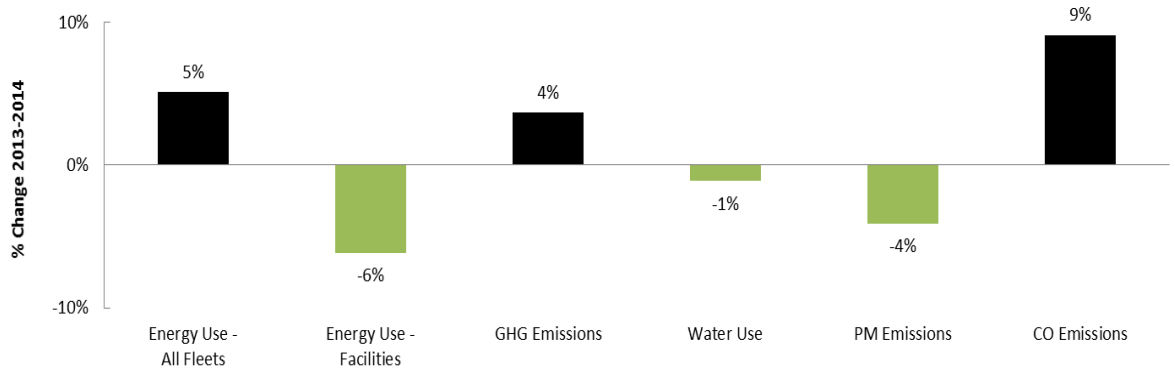


Table 3. Change in Energy Use per Mile of Service by Mode, 2013–2014

Mode	% Change Energy Use per Revenue Mile*
Sounder Commuter Rail (diesel)	9%
ST Express Buses (diesel and natural gas)	0%
Link light rail traction power (electricity)	-2%

*Note: ST Express bus energy use is normalized per platform mile.

Waste, Recycling and Composting

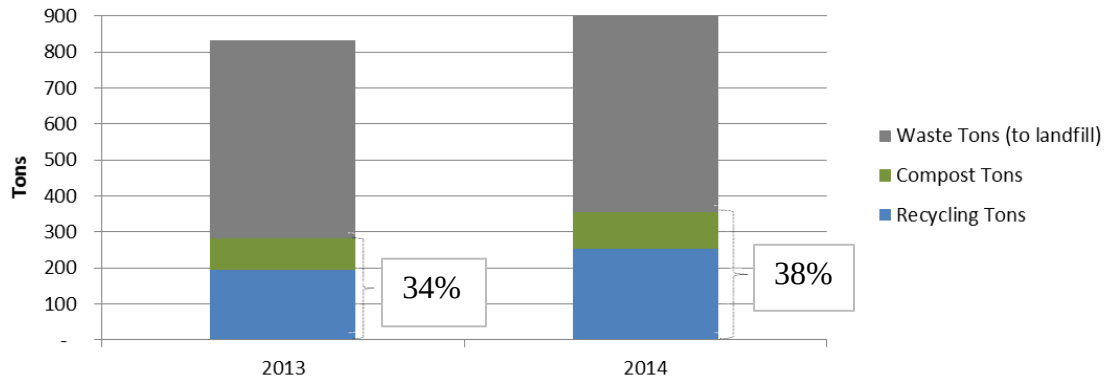
The overall waste diversion rate increased from 34 percent in 2013 to 38 percent in 2014. Although 11 percent more waste was generated, the proportion waste that was recycled and composted increased by 25 percent. Overall, the agency recycled and composted more than a third of that stream.

- Much of the increase in total waste is attributable to 2014 being the first full year that many consultants worked onsite at Union Station, increasing the number of employees present by at least one third.
- The increase in the diversion rate reflects the implementation of paper towel composting, standardized waste diversion bins and signage, and educational efforts.
- The agency recycled and composted 11 percent more of the waste stream at the agency's three main office buildings. Union Station was the primary driver of the increase in

diversion, with a 53 percent increase in its estimated diversion rate from 2013 to 2014. Recycling accounted for 77 percent of this increase in diversion, while 23 percent was through composting.

Figure 4. Change in Waste Diversion Rates, 2013–2014

Waste diversion measures the volume of the total waste stream that is diverted from the landfill to recycling and composting.



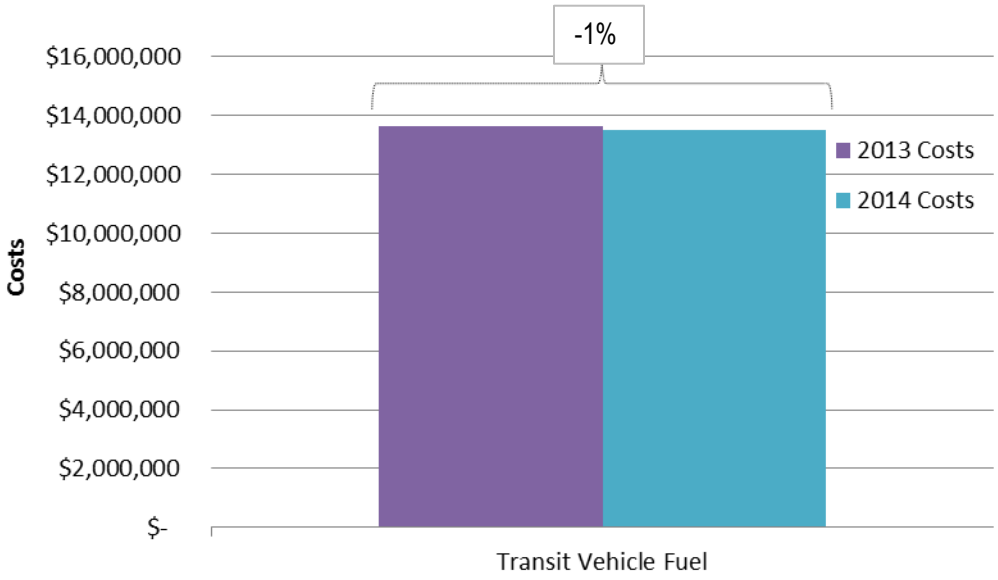
Operating Expenses

As expected for an expanding transit agency, operating expenses had a small overall increase. However, per passenger, expenses fell 2.6 percent per passenger.

- 2013 cost per passenger - $6.61
- 2014 cost per passenger - $6.43

Decreases in fuel costs resulted from reductions in the price per gallon of diesel ($3.07 to $2.94 per gallon) as well as gasoline ($3.60 to $3.54 per gallon). Transit vehicle fuel costs were down by just over $128,000 overall.

Figure 5. Changes in Fuel Costs, 2013–2014



Utility costs increased by approximately $96,000 in 2014 and were up across all utilities except natural gas. See Table 4. Facility natural gas use showed cost decreases due to reductions in use at the Link Operations and Maintenance Facility and Union Station.

Appendix B – 2014 Sustainability costs and savings

This table shows some of the major costs and savings from annual sustainability targets. Some significant program costs and savings are captured here. However, sustainability is integrated into many projects in ways that make it difficult to represent direct costs and benefits in these terms.

PROJECT	YEAR	CAPITAL COSTS	2014 SAVINGS	SAVINGS TO DATE	PAY-BACK YEAR	DESCRIPTION
CAPITAL INVESTMENT PAID BACK						
ST Express mid-day bus storage	2008	$0	$154,664	$1,612,661	2008	This program allows Pierce County buses to remain in Seattle until the afternoon commute to avoid driving back and forth empty. This storage saved over 60,000 gallons of fuel in 2014.
Sounder Automatic Engine Start-Stop System	2009	$230,596	$96,429	$406,066	2013	This equipment shuts down Sounder commuter rail engines when not in use. The AESS reduces engine idling time by about 34 percent and significantly reduces particulate matter and toxic air emissions.
Central Link OMF sewer meter	2012	$2,600	$47,728	$83,320	2012	Installing a deduct sewer meter at the Central Link light rail Operations and Maintenance Facility reduced sewer bills by accounting for the irrigation water that does not enter the wastewater stream.
CAPITAL INVESTMENT PAID BACK IN 1-3 YEARS						
Sounder Everett-Seattle wayside power	2011	$315,000	$5,946	$195,694	2016	Electric wayside power units are used instead of the commuter rail locomotives' diesel Head End Power units to heat and power coach cars during layover, reducing diesel and air pollutants.
Sounder Lakewood-Seattle wayside power	2010 2013	$490,000	$24,098	$252,750	2017	Electric wayside power units were installed in Tacoma in 2010 and then moved to Lakewood in 2013, where more units were added.

PROJECT	YEAR	CAPITAL COSTS	2014 SAVINGS	SAVINGS TO DATE	PAY-BACK YEAR	DESCRIPTION
CAPITAL INVESTMENT PAID BACK IN 5-7 YEARS						
Federal Way Transit Center lighting upgrades	2013	$603,000	$31,600	$51,500	2019	Four transit facilities were retrofit for energy efficiency upgrades. Lighting upgrades were made at Federal Way Transit Center and Kent and Auburn Sounder commuter rail stations. Union Station had upgrades made to its heating, ventilation and air conditioning (HVAC) system and controls. The 2014 Savings and Savings to Date columns in this chart only electricity savings. However, the payback period estimate reflects grants and utility rebates
Kent Station lighting upgrades	2013	$111,995	$11,127	$18,498	2019	
Union Station HVAC upgrade	2013	$407,845	$2,431	$15,246	2019	
Auburn Station	2013	$219,503	$8,198	$15,694	2019	

Appendix C – 2014 Sustainability–related grants

GRANT SOURCE	PROJECT NAME	YEAR	AWARD	DESCRIPTION
Washington State of Good Repair	Clean Green Fleet Replacement	2013	$5M	This project replaced seven, 40-foot conventional diesel buses at the end of their useful life with high-capacity, diesel-hybrid buses. This provides additional seating capacity (20+ seats per bus) on some of the ST Express bus routes with the highest ridership in the region.
Puget Sound Regional Council & Federal Transit Administration CMAQ	Diesel Retrofit of Commuter Rail Locomotives	2014	$5.3M	This grant enables Sound Transit to retrofit four to five Sounder Commuter Rail locomotive engines from Tier 0 to Tier 3 emissions standards. The 15-year old, locomotive engines will be upgraded to newer, Tier 3 EPA-certified engines, which are more fuel-efficient and have better emission control technology.
Puget Sound Regional Council & Federal Transit Administration Section 5307	Tacoma Link Expansion Vehicles	2014	$6M	Funds will be used to procure approximately six additional light rail vehicles for the expansion of Tacoma Link light rail. Light rail service conserves fuel and reduces emissions because it is powered by electrical power, which is cleaner than gasoline and diesel fuel.

Appendix D – 2014 Sustainability Performance measures

As part of the agency's Sustainability Plan, Sound Transit chose a suite of metrics to establish a baseline for sustainability performance. The agency first recorded the metrics in 2010 and updates them annually to assess progress.

The annual performance measures selected do not reflect one particular reporting framework or standard. The metrics include those used by other transit agencies and local governments, as well as those required by the American Public Transportation Association's Sustainability Commitment and The Climate Registry.

Primary Metrics

Ride – Provide safe, secure and reliable transportation choices			
Passenger miles traveled – TCR	425,704,135		
Boardings *Reported to APTA and NTD as unlinked passenger trips*	32,937,263		
Vehicle revenue miles – APTA, TCR	16,071,166		
Vehicle revenue hours – TCR *Hours of operation by service vehicles*	757,750		
Live – Support healthy, diverse, transit-oriented communities			
Boardings by station	See 2014 Service Implementation Plan		
Advocate – Increase community support for transit investments and services			
Favorability rating	69%		
Customer satisfaction	Overall – B+ (3.33/4) 46% rated Sound Transit "A" grade		
Percent of customers who believe taking Sound Transit is a good way to help the environment	68% strongly agree 25% somewhat agree		
Save Energy – Reduce energy use, greenhouse gas emissions and air pollution			
Energy use – APTA	Total	764,913 MMBTU	
	Per boarding	0.0232 MMBTU	
	Per vehicle revenue mile	0.0476 MMBTU	
Greenhouse gas emissions – APTA, TCR	Total	61,915 CO_2e	
	Per boarding	0.0019 CO_2e	
	Per vehicle revenue mile	0.0039 CO_2e	
Percent electricity from renewable sources *Source WA Dept. of Commerce 2014 and Sound Transit electric utilities*	83.8%		
Criteria air pollutant emissions – APTA	Units – lbs	Carbon monoxide	Particulate matter
	Total	527,905	24,326
	Per boarding	0.016	0.0007
	Per vehicle revenue mile	0.0328	0.0015
Protect Ecosystems – Protect natural habitats and conserve water resources			
Water Use - APTA	Total	33,818 CCF	
	Per boarding	0.001 CCF	
	Per vehicle revenue mile	0.0021 CCF	
Number of native plantings Installed in Sound Transit's wetland mitigation areas	615		

Use Less, Buy Green – Reduce materials consumption and increase recycling and environmentally preferable procurement		
Waste to landfill – APTA Not including construction waste	Total	568 tons/1,135,875 lbs
	Per boarding	0.0345 lbs
	Per vehicle revenue mile	0.0707 lbs
Percent of waste stream diverted to recycling - APTA	27.5%	
Percent of waste stream diverted to composting – APTA	11.0%	
Number of pesticides/harmful toxics used Number of harmful toxics yet to be baselined	7 pesticides	
Connect – Provide the mobility necessary for strong economic growth by connecting regional urban centers		
Percent of household budget spent on transportation *Source BLS 2014*	15.6%	
Average annual savings from public transit use *Source APTA 2014-2015*	$11,914.08	
Time per year in traffic	48 hours	

Note: 2014 data not yet available for the Seattle metropolitan area

Streamline – Incorporate sustainability into agency decision-making processes

Operating expenses
As reported in Sound Transit 2014 Adopted Budget; may differ from final expenses reported to NTD

Units - $	Sounder	Central Link	Tacoma Link	ST Express
Total	$38,883,489	$58,236,373	$3,948,030	$110,731,785
Per boarding	$11.57	$5.32	$4.10	$6.27
Per vehicle revenue mile	$24.24	$21.45	$52.00	$9.48

Engage – Enhance staff participation in sustainability initiatives	
Percent of annual sustainability targets met	89%

Key: Unless otherwise indicated all data is from Sound Transit

APTA	Data requested by the American Public Transportation Association's Sustainability Commitment
BLS	Data from the U.S. Bureau of Labor Statistics
NTD	Data required for submittal to the National Transit Database of the Federal Transit Administration
Partners	Community Transit (Snohomish County), King County Metro (King County), Pierce Transit (Pierce County)
PSRC	Data from the Puget Sound Regional Council Metropolitan Planning Organization
TCR	Data requested by The Climate Registry's Performance Metrics for Transit Agencies
TTI	Data from Texas Transportation Institute's Urban Mobility Report

Secondary Metrics

Ride - Provide safe, secure and reliable transportation choices		
Vehicle miles traveled per capita in region served – APTA *Source PSRC 2013 – Note: 2014 data not yet available*	22.73	
Number of people within Sound Transit district	2,873,505	
Passenger miles traveled per capita in region served	148.15	
Average weekday boardings by mode	ST Express	60,944
	Sounder	11,587
	Tacoma Link	3,286
	Central Link	32,925
On-time performance	ST Express	85.9%
	Sounder	95.1%
	Tacoma Link	99.9%
	Central Link	94.2%
Number of Regional Reduced Fare Permits	33,448	
Percent of ORCA cards sold as Regional Reduced Fare Permits	9.6%	
Security Fare inspection rate	7.13%	
Fare evasion rate	2.52%	
Save Energy – Reduce energy use, greenhouse gas emissions and air pollution		
Fuel use by mode	ST Express	3,315,819 gallons diesel 248,867 therms
	Sounder	1,310,021 gallons diesel
	Non-Revenue Fleet	51,121 gallons gasoline 19,677 gallons diesel
Greenhouse gas emissions – TCR	Per revenue vehicle hour	0.0817 tonnes of CO_2e
	Per passenger mile	0.0001 tonnes of CO_2e
Estimated greenhouse gas emissions displaced (avoided) by Sound Transit Services *Note: This data was developed using the APTA guidance document, Quantifying Greenhouse Gas Emissions from Transit, to assess how public transit displaces emissions from the combustion of motor fuels*	Mode shift – changes in the means of transportation	98,019 tonnes of CO_2e
	Congestion relief - reduced travel volume and traffic – source TTI 2013	39,911 tonnes of CO_2e
	Land use – change in density and development patterns	253,707 tonnes of CO_2e
Protect Ecosystems – Protect natural habitats and conserve water resources		
Wetland mitigation ratio – *acres mitigated to impacted*	3:1	
Connect – Provide the mobility necessary for strong economic growth by connecting regional urban centers		
Percent of downtown Seattle commuters using transit *Source Downtown Seattle Association 2014*	45.3%	
Engage – Enhance staff participation in sustainability initiatives		
Number of staff engaged in implementing the ESMS	70	

For more information contact esms@soundtransit.org
or visit soundtransit.org/sustainability